Translation

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P801430/WO/1	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP2003/013546	International filing date (*day/month/year*) 02 December 2003 (02.12.2003)	Priority date (*day/month/year*) 12 December 2002 (12.12.2002)
International Patent Classification (IPC) or national classification and IPC G01S 13/93		
Applicant DAIMLERCHRYSLER AG		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 11 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 10 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
28 June 2004 (28.06.2004)	23 March 2005 (23.03.2005)
Name and mailing address of the IPEA/EP Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/EP2003/013546

I. Basis of the report

1. This report has been drawn on the basis of (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

☐ the international application as originally filed.

☒ the description, pages _____, as originally filed,
pages 1, 3-9, 11-15, filed with the demand,
pages 2, 2a, 2b, 10, filed with the letter of 04 March 2005 (04.03.2005),
pages _____, filed with the letter of _____.

☒ the claims, Nos. _____, as originally filed,
Nos. _____, as amended under Article 19,
Nos. _____, filed with the demand,
Nos. 1-18, filed with the letter of 04 March 2005 (04.03.2005),
Nos. _____, filed with the letter of _____.

☒ the drawings, sheets/fig 1-12, as originally filed,
sheets/fig _____, filed with the demand,
sheets/fig _____, filed with the letter of _____,
sheets/fig _____, filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

I. 5 Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

1. The new feature in **claims 1 and 10** that the complex correlation function clearly assigns the phase information obtained (What information? The claim contains no definition) to a distance goes beyond the disclosure of the original application. Therefore, the requirements of **PCT Article 34(2)(b)** have not been met.

The passage cited by the applicant, namely page 8, line 14 to page 10, line 2 contains no support therefor. Rather, page 9, lines 1-10 indicate that the complex signal-response function, which, in the case of a pulse radar (apparently what is meant is the use of single pulses) entails a pulsed response, and when the PN code is used, entails a [complex] correlation function, has **maximum values** (no phase information) that correspond to the distances from target objects.

Instead, page 9, lines 15-27 indicate that **each correlation function maximum value** can be used to **read the phase of the corresponding target object signal**, thereby enabling a comparison of the correlation function of two receiving paths [meaning the paths of two adjacent receiving antennae] for each maximum value (which corresponds to a specific object distance) to be used to determine a phase difference between these receiving paths, which, in turn, corresponds to an object angle or an angle of incidence.

I. 5 Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

Therefore, in this case it is not that the phase information (what is meant here is the phase difference between the received signals of two adjacent receiving antennae) is first measured and then assigned to a distance using the correlation function, but rather, first the correlation function is determined in each of the two adjacent receiving paths, and then the distance and phase information is obtained from their maximum values.

Also, the feature "the phase information obtained" is unclear (PCT Article 6) because claims 1 and 10 lack a definition thereof.

Other observations with respect to the amendments:

2. The feature "the **principle of retrodirective arrays**" (see description, page 10, line 2) introduced into **claims 1 and 10** does not have a sufficiently clear definition among experts in the field. Firstly, the term "retrodirective" is used for active reflectors or transponders that re-emit a received signal (see **D7** (older document) or **D8** (more recent document). Furthermore, the term is used in conjunction with a directional effect of the antenna array in the receiving path that is achieved through belated calculation, which is related to the principle of adaptive arrays (**D10**). This principle is described in **D9** using the example of the cross-correlation of received signals.

I. 5 Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

Therefore, the subject matter of claims 1 and 10 lacks clarity (**PCT Article 6**).

In light of the description in the present application, it has been assumed for the assessment of novelty and inventive step that what is meant by the principle of retrodirective arrays, which is mentioned only on page 10, line 2 of the description, is the principle in D9 or a principle that is similar thereto (D10).

3. The **correction** of the formatting error on **page 10** of the description (the formulae were in the wrong place) is regarded as an obvious error (obvious that it is an error, and obvious from the flow of the text where the formulae were supposed to be) which either, according to **PCT Rule 66.5**, shall not be considered an amendment, or, according to **PCT Article 34 (2)(b)**, shall be considered an admissible amendment.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/EP 03/13546

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-18	YES
	Claims		NO
Inventive step (IS)	Claims		YES
	Claims	1-18	NO
Industrial applicability (IA)	Claims	1-18	YES
	Claims		NO

2. Citations and explanations

Documents cited in the procedure:

D1: DE 195 26 448 A (BOSCH GMBH ROBERT) 30 January 1997 (1997-01-30)

D2: DE 198 53 683 A (BOSCH GMBH ROBERT) 7 September 2000 (2000-09-07)

D3: WO 98/43111 A (MANNESMANN VDO AG; HASSLER GREGOR (DE); FLEISCHHAUER NORBERT (DE)) 1 October 1998 (1998-10-01)

D4: US-B1-6 215 438 (CLOUSTON ERIC NICOL ET AL) 10 April 2001 (2001-04-10)

D5: US-A-5 541 608 (MURPHY MYLES P ET AL) 30 July 1996 (1996-07-30)

D6: US-B1-6 184 830 (OWENS MARK A) 6 February 2001 (2001-02-06)

With this report, the Examiner has introduced the following documents into the procedure in order to clarify the term "retrodirective arrays", which was included in claims 1 and 10:

D7: US-A-3 518 672 (ZIMMER J T) 30 June 1970 (1970-06-30)

D8: US-A-2005/0030226 (MIYAMOTO R Y ET AL) 10

February 2005 (2005-02-10)

D9: GB-A-2208055 (RAYTHEON COMPANY) 15 February 1989 (1989-02-15)

D10: US-A-4 931 977 (KLEMES M) 5 June 1990 (1990-06-05).

1. Novelty

The subject matter of claims 1-18 is regarded as novel within the meaning of PCT Article 33(2) (for differences with respect to D1 as the prior art, see below).

2. Inventive step

The present application does not meet the requirements of PCT Article 33(1) because the subject matter of **independent claims 1 and 10** is not inventive within the meaning of PCT Article 33(3). The same applies to the subject matter of **dependent claims 2-9 and 11-18**. The reasons therefor are as follows:

2.1 **D1** discloses the following features of independent **claim 1** (and *mutatis mutandis* for claim 10, with a corresponding device):

- a multi-target method for locating short range target objects in terms of distance and angle (the aim of D1 is the distance measurement known from the prior art, see column 1, lines 6-44, in order to supplement an angle measurement, see column 1, lines 48-59 and column 2, lines 9-30; the short range is also detected by this type of radar)

a) the transmission of a characteristic signal

(for example, a pulse or CW signal, column 2, line 11) by means of a transmitting antenna (figure 1, #3) of a first sensor element (figure 1, #3, #7);

b) the receipt of the reflected characteristic signal by at least two adjacent receiving antennae (figure 1, #4 and #5, what is meant here is the bistatic design in D1, column 2, line 46 or column 4, line 21) of the first sensor element (figure 1, #3 and #7);

c) the measurement of the running time differences of the reflected characteristic signal with respect to the two adjacent receiving antennae of the first sensor element in order to determine the distances of the target objects to the first sensor element (figure 1, #4 and #5, bistatic design, column 2, line 46 or column 4, line 21; since D1 improves the distance measuring systems of D5 and D6, bistatic distance measuring is implicit in D1);

d) the measurement of the phase differences of the reflected characteristic signal between the two adjacent receiving antennae (figure 1, #4 and #5, bistatic design, column 2, line 46 or column 4, line 21; column 2, line 9, phase difference) of the first sensor element in order to measure the angle of the target objects with respect to the first sensor element (column 4, lines 28 ff.).

If the above-mentioned interpretation of the term "retrodirective arrays" is used as a basis, then the new feature that

- the angle with respect to the target objects

is measured in that the phase differences in the signals of the receiving antennae are used to estimate the angle of incidence for each target object individually according to the principle of retrodirective arrays,

means only that the direction (angle) with respect to each target object is determined from the phase difference in the received signals of adjacent antennae (or receiving elements in D1), and this, according to the principle of retrodirective arrays, can also be considered to be a directional effect of the antenna system that was obtained in the receiving path by means of calculation, the antenna system consisting of two adjacent antennae (= array; in D1: two receiving elements).

This feature is disclosed in D1, since there too, the direction with respect to each of the objects is determined in the same manner (column 2, lines 11-16).

Therefore, the subject matter of claim 1 (and 10) **differs** from the disclosure in D1 in that

- each of the transmission signals reflected [from target objects] and received by the [two adjacent] receiving antennae can be subjected to a correlation with the characteristic signal in order to determine a complex correlation function [the maximum values of which each correspond to a distance from a target object].

The resulting **objective technical problem** to be solved can be regarded as that of rendering the device and method according to D1 less sensitive to erroneous detection, in particular that of ghost

targets or interference. Ghost targets can, as a person skilled in the art is aware, arise as a result of interference or ambiguities in distance measurement.

D1 already discloses a simple type of distance measurement by means of run time measurement for pulsed multisensor arrangements wherein the ambiguities in the object angle are already eliminated by the phase difference measurement between adjacent receiving elements.

A person skilled in the art attempting to solve the above-mentioned problem would consult the literature and, in **D2**, would find a design that is compatible with D1, in which design the run time measurements are carried out via encoded pulse trains (= pseudo-noise codes or stochastic pulse trains) that are correlated in an adaptive filter (FIR filter). This correlation according to D2 also results in a complex correlation function with maximum values that correspond to a specific object distance (which is implicit in D2). D2 also aims to solve the above-mentioned problem (column 2, lines 21-32).

Therefore, a person skilled in the art would inevitably combine D1 and D2, thereby arriving at the subject matter of claims 1 and 10.

Furthermore, a person skilled in the art also knows that, depending on how clearly or finely structured the encoded pulse train is, and depending on how sharp the correlation maximum values thereby become, not only the distance, but also the phase, can be measured more precisely. Therefore, owing to the

obvious combination of D1 and D2, the features on page 9 of the application that relate to obtaining phase information from the maximum correlation values are also rendered obvious.

2.2 In addition, D1 discloses the features of the dependent claims as follows:

Claims 4 and 13: The characteristic signal is an FMCW, pulse, or pseudo-noise signal (column 2, line 11; see also D2, column 2, lines 34 ff.)

Claims 5 and 14: Networking a multiplicity of sensor elements (Figure 1, #3-5 are networked, for example in #10)

Furthermore, D1 renders obvious the features of the dependent claims as follows:

Claims 2 and 11: It is obvious to a person skilled in the art that the sensor elements can also transmit and receive in bistatic mode, i.e. that each of the antenna or sensor elements #3-5 can transmit, and the others can receive.

Claims 3 and 12: In light of the teaching in D1, the fact that steps e)-h) can be carried out only if no run time difference was detected in steps a)-d) appears to be a standard

design measure.

Claims 6, 7, 15 and 16: Varying the antenna characteristic and pivoting the lobes are well known to a person skilled in the art and rendered obvious by D1, column 2, lines 36-43.

Claims 8 and 17: The fact that the distance from two sensor elements is greater than [the] distance resolution of each of the individual sensor element[s] is a standard design measure.

Claims 9 and 18: The measurement of the run time differences of the reflected characteristic signal includes the determination of the maximum values of the signal-response functions of the characteristic signal and the measurement of the phase differences takes place at the respective maximum values are also standard design measures, since the phase difference, and therefore the target angle, is important only for objects (maximum values).

2.3 D3 is less relevant. In D3, first monostatic (direct) object distances are determined and then compared with bistatic (indirect) distance measurements (figure 2). No comparison of the

bistatically determined run times between two adjacent sensors takes place.

D4 is also less relevant, since it does not relate to ambiguities (simple triangulation, figure 7, column 10, line 64 to column 11, line 17).

D5 and D6 (mentioned in the application on page 7) relate merely to embodiments for obtaining information with respect to the run time difference between two channels (for example, I/Q detector).

3. **Observations:**

3.1 In light of the prior art, it cannot currently be determined what part of the application could form the basis for a novel, independent, admissible claim.

3.2 Additional defects:

a) The requirements of PCT Rule 6.3(b) have not been met, since the independent claims 1 and 10 have not been drafted in the requisite two-part form in view of the closest prior art according to D1.

b) The requirements of PCT Rule 5.1(a)(ii) have not been met, since D1-D3, which belong to the relevant prior art, have not been acknowledged in the description.

c) The last paragraph on page 15 (lines 29-34) is irrelevant (PCT Rule 9.1(iv)).